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AGRICULTURE, MARKETING AND THE ENVIRONMENT–PROBLEMS AND RESEARCH NEEDS

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MARKETING ECONOMICS DIVISION
ECONOMIC RESEARCH SERVICE
U.S. DEPARTMENT OF AGRICULTURE

ERS-490

Reprinted from
Marketing and Transportation Situation
August 1971

AGRICULTURE, MARKETING AND THE ENVIRONMENT—PROBLEMS AND RESEARCH NEEDS

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ABSTRACT: Marketing firms will be directly affected by implementation of programs to improve the environment, since problems in agriculture are substantial. Firms must seek least-cost solutions to such problems in producing, input supplying, processing, and distribution. Many technological alternatives exist, but their application will be influenced by the size, location, and functions of firms, and the economic uses for byproducts from wastes. Comprehensive research programs are needed to aid firms and public agencies in achieving pollution abatement with a minimum of adverse impacts on agricultural industries.

Key Words: Marketing, environment, pollution, research methods.

Environmental quality problems may seem to have emerged only recently as a matter of public concern. But they have existed for a long time. With the effects cumulative, we have now crossed the threshold of public awareness.

Pollution is not wholly the product of man's exploitation. Many sources of pollution are natural. Environmental problems arise because these processes are speeded up by man interacting with his environment and adding new pollutants.[1] Agricultural production and marketing contribute substantially to pollution.

Environmental issues accentuate the direct concern of marketing firms with problems related to producing and processing, input supplying, and retailing and distribution. Marketing firms also have a heightened awareness of the problems facing transportation and supply services they depend upon and of the concerns of consumers and various levels of government.

The firm is an organized behavioral system seeking equilibrium at three different levels. The first is the control and balance of forces within the firm so it can survive and develop. The second is a market equilibrium with other competitive firms in the industry. A third level increasingly involves the firm and its environment. This embraces the social and physical environment and other external factors relevant to the survival and success of the firm, and which, in turn, might be critically affected by the firm's actions.[2]

Laws and regulations relating to pollution have existed at the Federal, State, and local level for many years. Many have not been fully enforced and some have not been used at all. Recently new regulations, ordered into effect by the President, established a mandatory permit system for all industries discharging wastes into navigable waters. These implemented provisions of the 1899 Refuse Act. This program now applies to confined feeding operations with 1,000 or more animal units per year. An animal unit is based on the biochemical oxygen demand (B. O. D.)[3] equivalent of one beef steer. One thousand animal units equals 700 dairy cows, 4,500 butcher hogs, 12,000 sheep, 35,000 feeder pigs, 55,000 turkeys, 180,000 laying hens, or 290,000 broilers as well as 1,000 cattle on feed.[4]

Regulations which will affect marketing firms are also being developed and implemented under other legislation. Under the Water Quality Act of 1965, States are charged with primary reponsibility for implementing and enforcing water quality standards for their interstate waters. State water quality standards must meet Federal approval. State-Federal water quality standards are ultimately subject to Federal enforcement, if necessary. The 1970 Clean Air Act contained more stringent air quality measures than any previous legislation. Individual State and local governments have also enacted much new environmental legislation.

Causes of Environmental Problems

Some causes of the current problems are: (1) Population growth and concentration, (2) emphasis on physical and economic efficiency at the expense of social costs, (3) consumer demands for added services and convenience, (4) insufficient attention to the relationships within economic systems and between economic and ecological systems, and (5) failure to act earlier.

Air, water, and land have a natural capacity for absorbing some pollutants and transforming them into harmless forms. But the capacities of these resources to absorb pollutants without deteriorating in quality are limited. Transgressions of these limits are evidenced by polluted rivers and unclean air. Increases in population and in production of goods and services, along with increasing concentration of population in urban areas, have had adverse effects on natural resources. The U.S. population increased over 13 percent from 1960 to 1970 and production in real terms about 50 percent. Two-thirds of our people now occupy only 9 percent of the land base. Thus, water, sewage, and land-fill problems in metropolitan areas have become serious. Moreover, population density has accentuated air, odor, and noise pollution problems.

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[1] Jansma, J. Dean, "The Economics of Environmental Quality-The Identification of Trade-Offs," Paper, Northeastern Agricultural Economics Council annual meeting, Amherst, Mass., June 22, 1971.

[2] Alderson, Wroe. "A Normative Theory of Marketing Systems," in *Theory in Marketing,* Eds. Cox, Alderson, and Shapiro (Homewood, Ill.: Richard D. Irwin Inc., 1964), p. 94-95.

[3] B.O.D. is a measure of the dissolved oxygen in water required to biologically degrade organic matter.

[4] Ruckelshaus, W.D., Statement of the Administrator, Environmental Protection Agency, before the Committee on Agriculture, House of Representatives, May 25, 1971.

Much of our economic development occurred without full regard for environmental impacts. Too often physical and economic efficiency has been pursued at the expense of clean air, water, and land. Improvements in material well-being have not fully reflected the social costs of deteriorating environmental quality. For example, high yields in agriculture have helped hold down the cost of farm products entering marketing channels. But this has often been achieved through the use of pesticides, chemicals, and additives with potential pollutant or residual effects.

Many added processing activities have required greater water consumption and increased requirements for waste treatment facilities. The growth of large-scale units in production and processing has increased the geographical concentration of wastes and the potential for either damage or economical recovery of wastes. The demands of consumers for, or their acceptance of, added services and convenience items have contributed materially to the waste load from discarded packaging and containers.

Pollutants and Pollution

Confusion exists in terminology used in discussing environmental or pollution problems. This involves types of pollutants, kinds of pollution, methods of transmission, and causes and effects. Semantic difficulties occur because environmental questions are very complex. Table 12 presents examples of pollutants from agriculturally related sources. The transmission of pollutants occurs by air, water, and plants, insects, animals, and equipment, often in combination or in sequence. Table 13 presents examples of agriculturally related pollution.

Air pollution in agriculture may be less important than in the industrial sector. Yet, agriculture is affected by air pollution caused by transportation methods it uses and any added costs for these services due to future abatement efforts.

Organic wastes are a major problem in the agricultural sector. These byproducts of production and manufacturing processes, when carried in water, produce a high biochemical oxygen demand. This can cause depletion of dissolved oxygen in waters supporting fish and other forms of life. Recreational and aesthetic values of the receiving waters are reduced, and subsequent domestic and industrial users incur costs in making water fit for their purposes. Dry organic wastes on land may be combustible, produce odors, and attract flies and other vermin. Odor, along with noise, has become a major problem for livestock and poultry producers who have neighbors close by.

Farm-level organic wastes are mainly animal manure and bedding, dead animals, and leaves, stalks, stubble and culls from agricultural crops. Trends in livestock, milk, poultry, and egg production toward automation, geographic concentration, confinement production, and expanding sizes of production units result in concentrated volumes of animal wastes in rural areas. Public pressures and urbanization may force producers to relocate or change conventional methods of animal waste disposal.

Farmers have made rapid strides in production technology. However, economies of scale of production have not been matched by similar developments in the collection, handling, treatment, reclamation or disposal of animal waste. The interaction of several factors determines the severity of animal waste problems, including the type and volumes of wastes produced, the distribution of sources, the proximity to people, the physical environment characteristics, and the uses and demands on natural resources.

Processing firms convert farm commodities into various products. Organic wastes, such as animal blood, tissues, and fruit and vegetable tissues, are a result. Escape of such wastes in processing plant effluent significantly increases B. O. D. loading. High levels increase the difficulty and cost of waste water treatment. Untreated effluent discharged directly into a natural waterway may cause oxygen depletion.

Collection of wastes in modern plants is complex because large volumes of water are used in processing and cleaning. A large broiler slaughtering and eviscerating plant requires a million gallons of potable water per day, and a sewage treatment plant large enough to serve the equivalent of 25,000 people. Liquid wastes from processing operations include blood, canning liquors, processing waters, and dissolved, suspended, or floating particles of solid matter. Plants having access to municipal sewage treatment facilities may not have to invest in private treatment facilities, but may be faced with municipal surcharges on B. O. D. and suspended solids.

The packaging and container wasteload generated by modern methods is substantial. A representative of a large chain stated recently:

> "For every 100 pounds of groceries that our customers carry out the front door, we have four to five pounds of waste in the back room. We are shipping about 1¼million pounds of paper per week—about 42 rail cars—back to the paper mills."[5]

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[5] Institute of American Poultry Industries Newsletter, May 12, 1971.

Table 12.—Examples of types of pollutants from agriculturally related sources[1]

Type of pollutant	Source
Dust	Cotton ginning, alfalfa processing, farmlands, cattle pens, feed milling, wind erosion
Sediment	Land erosion
Plant nutrients	Runoff from cropland, feedlots, barnyards
Inorganic salts and minerals	Irrigation, drainage
Organic wastes	Livestock and poultry production, crops, orchards, paper manufacturing, fruit and vegetable processing, dairies, slaughtering and processing of meat animals and poultry, manufacturing of cornstarch and soy protein, sugar refining, fermenting, malting, distilling, scouring of wool, wet processing in textile mills
Infectious agents and allergens	Farm runoff, sewage, animal wastes, insects
Agricultural chemicals	Dust, runoff, plants, animals, equipment

[1] Based mainly on information in Wadleigh, C. H., *Wastes in Relation to Agriculture and Forestry,* USDA, Misc. Publ. No. 1065, March 1968. In the classification used in this report, radioactive substances, chemical air pollutants, industrial chemicals, and heat were also listed as pollutant sources, but originating almost entirely outside agriculture. For the seven classifications in the above table agriculture is an important or major source of pollutants.

Table 13.—Examples of kinds of pollution from agriculturally related causes

Kinds of pollution	Sources	Effects
Air (particulate suspension)	Processing plants, feedlots, and transportation vehicles	Nuisance, traffic hazard, possible health hazards
Water	Farms, processing plants	Raise water and sewage treatment costs, health hazards, limit recreational uses, disturb ecological balances
Land	Farms, processing plants	Restrict nearby land and water use.
Odor	Nearby farms, rendering plants, processing plants	Nuisance
Noise	Nearby farms, processing and distributing plants	Nuisance
Aesthetic	Unattractive farm, processing, distributing plants, access roads, waste accumulation, billboards	Scenic impairment, lower property values, restricted nearby land use

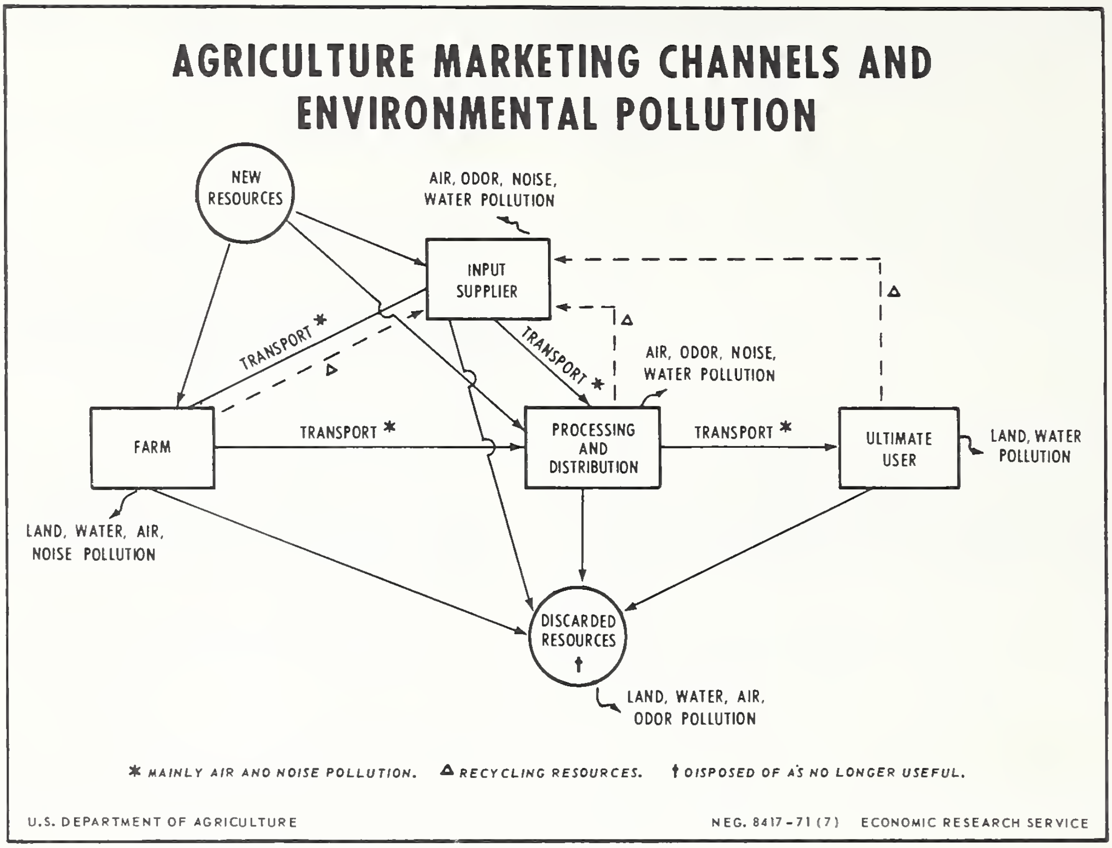
Other retail firms encounter similar problems and many have initiated recycling programs. Recycling will alter practices and costs of the marketing system, if many items are involved. Ultimate users also must dispose of packages and containers. Much of this material could be recycled or biodegraded. Convenience and snack packaging was recently cited as the leading source of litter, but the role of packaging in preventing both product damage and deterioration cannot be disregarded.

Figure 6 illustrates the kinds of pollution produced at various stages in production and marketing channels. It underlines the relationships among these stages and the public impacts of industry actions.

Alternative Approaches to Pollution Abatement

Means of minimizing environmental impacts are: (1) Slowing the "using up" of natural resources which are becoming scarce, (2) reducing the various forms of pollution resulting from producing, input supplying, marketing, and consuming functions, (3) recycling within production-marketing channels to minimize "discarded resources", and (4) relocating various activities to aid in pollution abatement and to minimize adverse environmental impacts.

Firms must seek least-cost solutions to pollution control problems. The impact of added costs will vary from industry to industry and from firm to firm. No universal solution exists. Firm size, type, location, and available technology affect least-cost solutions. A major problem in posed by the uncertainty of what will constitute acceptable standards in the future. Existing operations must be modified and new operations designed to comply with acceptable standards. Present investment in pollution control to meet existing standards may not be sufficient. Variations in State and regional standards could alter the competitive position of certain firms.


AGRICULTURE MARKETING CHANNELS AND ENVIRONMENTAL POLLUTION

NEW RESOURCES
AIR, ODOR, NOISE, WATER POLLUTION
INPUT SUPPLIER
TRANSPORT *
Δ
TRANSPORT *
Δ
AIR, ODOR, NOISE, WATER POLLUTION
Δ
FARM
TRANSPORT *
PROCESSING AND DISTRIBUTION
TRANSPORT *
ULTIMATE USER
LAND, WATER POLLUTION
LAND, WATER, AIR, NOISE POLLUTION
DISCARDED RESOURCES †
LAND, WATER, AIR, ODOR POLLUTION

* MAINLY AIR AND NOISE POLLUTION. Δ RECYCLING RESOURCES. † DISPOSED OF AS NO LONGER USEFUL.

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Figure 6

Field spreading can be adequate for treatment and disposal of animal manures, and recovery of plant nutrients helps reduce disposal costs. Improvements on conventional spreading methods to further reduce runoff and odor include subsoil application. If disposal on land is not feasible due to limited land areas, population density, or other factors, other methods must be utilized. Properly designed and constructed lagoon systems provide an economical means of decomposing manure through biological action. More sophisticated methods being evaluated experimentally include pyrolysis and industrial-type treatment systems.

Another approach is the utilization of animal manure as organic fertilizer and feedstuffs. At present price levels, limited amounts of animal manures are being profitably dried mechanically, pelletized, and bagged for sale. Dehydrated poultry waste (DPW) has been fed experimentally to livestock and poultry. The commercial drying process pasteurizes the manure, and the end product is high in protein and other nutrients, but low in energy. In feeding trials, DPW replaced up to 25 percent of the corn in rations for caged layers, with little influence on egg production. Even at this level of replacement, all manure produced by a flock could be used. Presently the recycling of poultry manure as a feedstuff is not sanctioned by the Food and Drug Administration. This may reflect concern over the drug content of poultry feed and pathogenic organisms which might be transmitted.

Process modification, equipment modification, water reuse, and isolation of waste and reduced water use can bring about decreases in costs for water and organic waste treatment in processing plants. Often, relatively small capital investments in equipment changes can result in significant water saving. Blood collection in poultry processing plants can reduce the B. O. D. loading of plant effluent, since blood contributes 40 percent of the B. O. D. loading. Pretreatment— including byproduct recovery of blood, feathers, and offal through screens and traps, and solids recovery in settling or catch basins—minimizes waste loadings of treatment facilities and treatment cost. There are several incentives for firms to collect byproducts. By doing so, they can avoid municipal surcharges on B. O. D. and suspended solids, meet water quality standards, reduce private treatment costs, and gain the economic value from byproducts.

Utilizing or recycling collected wastes can help solve waste management problems. Some poultry firms collect blood, offal, and feathers from processing operations and render them into a byproduct meal which is used in poultry rations. Specialized renderers serve as an outlet for firms not having rendering facilities. Some wastes from the fruit and vegetable industry are also being utilized as animal feeds. Peach pits can be converted into charcoal and charcoal briquets. Research is underway to provide new methods of utilizing collected processing wastes.

Current industry processing and marketing practices often determine types of products produced. Returns from some products may not justify costs involved. Giblets account for 10 percent of broiler carcass weight, but in-plant handling requires 45 percent of the water, 20 percent of the plant labor, and contributes 15 percent of the wasteload.[6]

The Research Problem

"The problem of pollution is many problems. . .a health problem of ever-expanding dimensions. . .an economic problem intimately and directly affecting many industries and agriculture, both large and small. . .a social problem creating constraints on the nature and direction of urban and regional development and patterns of land use. . .a resources problem, for most of what we discard as waste was, in an earlier phase, a useful resource or material . . . a political-institutional-management problem in which the fragmented and diverse nature of our efforts to explore, understand, and direct movement and disposition of our wastes is clearly demonstrated. . .throughout the United States. . ."[7]

Relationships among various functions and various subsectors have too frequently been neglected in economic analysis. The scope of research must be broadened to deal with environmental problems. Such research requires simultaneous application of principles and relationships from natural science, engineering, and the social sciences. Thorough research methods can help prevent the continued neglect of certain aspects of environmental problems. The following elements should be involved: (1) Specifying variables and relationships within a conceptual model to identify research needs and gaps in scientific knowledge, (2) applying the model to case study situations to perfect analytical approaches, and (3) studying the powers of implementing agencies and how they can best be directed toward results in the public interest.[8]

Pollution abatement may necessitate significant changes in agricultural industries. With more stringent regulations certain, and analysis specific to particular industries lacking, comprehensive programs of research are urgently needed. Research must examine pollution abatement programs in terms of environmental quality, efficiency and equity, consider possible repercussions as well as new opportunities, and estimate relevant tradeoffs. Research should be tailored to specific industries and often to conditions in defined geographic regions.

Recently, a research committee[9] proposed an economic analysis of the impact of pollution control on poultry and egg marketing. The following objectives are based on that proposal, but have been broadened to serve as an example of an industry or subsector approach to research on environmental problems: (1) Study alternative mathods available for handling and disposing of pollutants. Determine the associated fixed and variable costs for various size of units, locational situations, and degrees of pollution abatement, (2) determine costs and returns from collection and reprocessing of agricultural wastes into useful products, (3) examine announced standards. Study alternative techniques for allocating costs among producing units, input supplying and marketing operations, consumers, or the general public. Evaluate the resulting impacts on industry firms, (4) determine present and future dollar and social costs and returns associated with potential pollutants under various regulatory approaches. Develop recommendations for modifying, standardizing, and improving regulatory approaches, and (5) study the effects of pollution abatement on interregional competition in the specific industry, and on the location of particular functions within areas, including specific geographical points.

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[6] Crosswhite, William M. "Implementation of Effective Pollution Control by Food Processors," paper prepared in the Department of Economics, North Carolina State University, 1971.

[7] Nat'l Acad. of Sciences, Nat'l Research Council. *Waste Management and Control.* A report to the Fed. Council for Science and Technology, 1966, Fourth printing, Sept. 1967, p. 8.

[8] Herfindahl, O. C. and Kneese, A. V. *Quality of the Environment.* Resources for the Future, Inc. (The Johns Hopkins Press, Baltimore, Md.), 1965, Third printing, 1969, p. 81-96.

[9] Northeastern Poultry Marketing Research Committee (NEM-39), June 1971.